

Fungal Biodegradation of Carbofuran and Carbofuranphenol by Fungus *Mucor ramannianus* : Identification and Toxicity of Metabolites

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Abstract

Carbofuran, a class of *N*-methyl carbamate pesticides, is highly toxic and an inhibitor of acetylcholinesterase, an enzyme vital for functioning of the central nervous system¹⁾. Carbofuran has been known to be hydrolyzed to carbofuranphenol, which is the major product the most often found in water²⁾. Soil fungus, *M. ramannianus* was used to elucidate the metabolite pathway of the pesticide carbofuran and its hydrolysis product carbofuranphenol. Elution profiles of high pressure liquid chromatography equipped with a reverse phase C-18 column showed four peaks and one peak produced from carbofuranphenol and carbofuran, respectively, by *M. ramannianus*. LC/MS analysis suggested that two of the metabolites produced from carbofuranphenol were most likely to be 2-hydroxy-3-(3-methylpropan-2-ol)phenol³⁾ and 3-hydroxycarbofuran-7-phenol. The metabolite produced from carbofuran had a different retention time, as compared to those of metabolites from carbofuranphenol. Based on the metabolites, *M. ramannianus* may adopt different tracks of metabolism for carbofuran and carbofuranphenol although two compounds have similar structures. Biological toxicity with carbofuran, carbofuranphenol, 2-hydroxy-3-(3-methylpropan-2-ol)phenol³⁾ and 3-hydroxycarbofuran-7-phenol were tested using freshwater zooplankton *Daphnia magna*. The results, which are the first reports of the metabolism of carbofuranphenol by fungus, will inform of valid information for the environmental risk assessment related with pesticide carbofuran.

References

1. Fahmy MA, Fukuto TR, Meyers RO and March RB. The selective toxicity of *N*-phosphorothioyl carbamate esterase (1970), *J. Agric. Food Chem.* 18: 793-796.
2. Atrache LL and Sabbah S Determination of phenyl-*N*-methylcarbamates and their hydrolysis products in water, using solid-phase extraction and reversed-phase liquid chromatography with UV and electrospray mass spectrometric detection (2003). *Can. J. Chem.* 81(9): 971-981.
3. Kim, IS., Ryu JY., Hur, HG., Gu, MB., Kim, SD. and Shim, JH. *Sphingomonas* sp. Strain SB5 Degrades Carbofuran to a New Metabolite by Hydrolysis at the Furanyl Ring (2004). *J. Agric. Food Chem.* 52: 2309-2314.